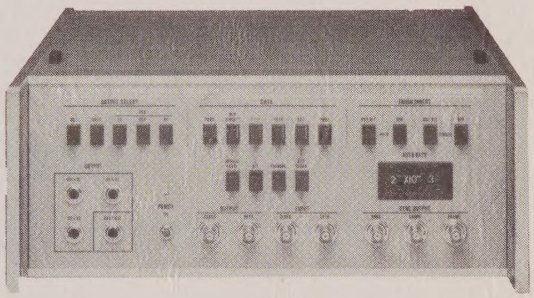
OPERATOR'S MANUAL

Model 4653A
Error Rate Transmitter



Scientific
Atlanta

Digitized by the Internet Archive
in 2025

https://archive.org/details/manualsplus_06527

Scientific
Atlanta

Model 4653A
Error Rate Transmitter

Operator's Manual

First Edition

September, 1983

Copyright © 1983 Scientific-Atlanta All Rights Reserved
Printed In U.S.A.

PUBLICATIONS NO. 35G036Z

MANUAL PART NO. 256025

WARRANTY

Each standard catalog product manufactured by Scientific-Atlanta, Inc., is warranted to meet all published specifications and to be free from defects in material and workmanship. The company's liability under this warranty is limited to servicing or adjusting equipment and/or replacement of defective parts of any equipment returned to the factory, freight paid by buyer, within a period of one year from date of shipment from the factory, unless a shorter period is specified. Equipment showing damage by misuse, or abnormal conditions of operation, shall be excluded from this warranty. Scientific-Atlanta, Inc., shall in no event be responsible for incidental or consequential damages, including without limitation personal injury or property damage.

Tubes used in Scientific-Atlanta, Inc., equipment carry standard tube manufacturers' warranties which may be fulfilled directly from the tube manufacturer or its distributor. Microwave tubes failing within the stated warranty period should be handled directly with Scientific-Atlanta, Inc., in accordance with instructions packed with the equipment or tube. Cable and other items manufactured by others and not made an integral part of equipment of Scientific-Atlanta's manufacture shall carry the original manufacturer's warranty.

Products manufactured by Scientific-Atlanta, Inc., to customers' specifications are warranted to be free of defects in material and workmanship and shall conform to all specifications made a part of the contract or purchase order. Inspection and acceptance shall be conclusive as to fulfilling this warranty, except as to latent defects providing, however, that all claims made or to be made for any reason must be made in writing within one year of shipment from Scientific-Atlanta's plant. Scientific-Atlanta, Inc., responsibility under this warranty shall be limited to repair or replacement of defective work or parts returned to Scientific-Atlanta, Inc., with transportation charges to Scientific-Atlanta, Inc., plant and return paid by buyer. Scientific-Atlanta, Inc., may at its option elect to correct any warranty defects by sending its supervisory or technical representative at Scientific-Atlanta, Inc., expense to customer's plant or location within the continental United States to make on-site corrections. Scientific-Atlanta, Inc., shall in no event be responsible for incidental or consequential damages, including without limitation personal injury or property damage. SINCE SCIENTIFIC-ATLANTA, INC., HAS NO CONTROL OVER CONDITIONS OF USE, NO WARRANTY IS MADE OR IMPLIED AS TO SUITABILITY FOR CUSTOMER'S INTENDED USE, BEYOND SUCH PERFORMANCE SPECIFICATIONS AS ARE MADE A PART OF THE PURCHASE ORDER. THERE ARE NO WARRANTIES, EXPRESS OR IMPLIED, EXCEPT AS STATED HEREIN. This limitation on warranties shall not be modified by verbal representations.

Equipment shipped F.O.B. Scientific-Atlanta, Inc., plant shall become the property of buyer upon delivery to and receipt from carrier. Damage in shipment should be handled by the buyer directly with the carrier by immediately requesting carrier's inspection upon evidence of damage in shipment. DO NOT RETURN ANY SCIENTIFIC-ATLANTA PRODUCT TO THE FACTORY UNTIL SHIPPING INSTRUCTIONS ARE RECEIVED.

SCIENTIFIC-ATLANTA, INC.

INSTRUMENTATION

TABLE OF CONTENTS

Section		Page
	CHAPTER 1 GENERAL INFORMATION	
1.1	General	1-1
1.2	Purpose of Equipment	1-1
1.3	General Description	1-2
1.4	Technical Characteristics	1-2
	CHAPTER 2 INSTALLATION	
2.1	General	2-1
2.2	Unpacking and Inspection	2-1
2.3	Accessories Supplied	2-2
2.4	Installation	2-2
	A. Power Source	2-2
	B. Typical Test Configurations	2-5
	CHAPTER 3 OPERATION	
3.1	General	3-1
3.2	Front Panel Controls and Indicators	3-1
3.3	Rear Panel Connectors	3-6
3.4	Operation	3-6
	A. Output Select	3-7
	B. Data Type Select	3-7
	C. Error Insert Select	3-12
	D. Output Connectors	3-13
	E. Input Connectors	3-13

LIST OF ILLUSTRATIONS

Figure	Title	Page
2.1	Selecting the Proper Operating Voltage	2-4
2.2	Typical Configurations for Testing Digital Networks with the Model 4653A/4654A Error Rate Test Set	2-6
2.3	System Loop-Back Test Using Model 4653A/4654A Equipment, Block Diagram	2-7
2.4	Digital Modem Test	2-7
3.1	Model 4653A Transmitter, Front Panel Controls and Indicators	3-3
3.2	Typical Rear Panel Features	3-6
3.3	Location of Programmable Data Pattern Switches and Zero Suppression Jumper	3-9
3.4	Location of DS1 Framing Selection Jumper	3-11

LIST OF TABLES

Table	Title	Page
3.1	Identification of Controls and Indicators	3-2

CHAPTER 1
GENERAL INFORMATION

1.1 GENERAL

This instruction manual contains information for installing and operating the Scientific-Atlanta Model 4653A Error Rate Transmitter. The theory of operation, maintenance, parts listing, and applicable drawings are contained in a separate instruction manual identified-MAINTENANCE.

We recommend before operating this unit, or attempting a repair adjustment, reading the appropriate sections in these manuals carefully. Factory or customer specified modifications, when applicable, and/or general instruction manual updating will be provided in the rear cover envelope labelled "Manual Update Information".

1.2 PURPOSE OF EQUIPMENT

The complete Model 4653A/4654A Error Rate Analyzer Set consists of two units: (1) the Model 4653A Transmitter, and (2) the Model 4654A Analyzer. These units are designed to aid in testing digital-to-digital measurements on digital transmission equipment such as DS1, DS1C, or DS2 digital data links. The Model 4653A Transmitter generates test signals and the Model 4654A Analyzer performs a variety of error measurements on the received data.

Normally, the Model 4653A Transmitter is connected to a DS1/1C/2 transmitter which sends digital data over various media (microwave, optical, cable).

The Model 4653A/4654A Transmitter/Analyzer configuration provides total measurement capability for field use, commissioning, or laboratory tests.

1.3 GENERAL DESCRIPTION

Four independent transmitter output connectors are available on the front panel. All four can supply a DS1 or DS1C signal while only one of these four provides a DS2 signal. Separate BNC-type output connectors on the front panel provide a buffered transmitter output signal for CLOCK and DATA in NRZ unipolar format. The output signal is selected as "PRBS" (Pseudo-Random Bit Sequence), "MIN DENSITY", "1111", "1010", "EXT" (external data), or "PROG" (programmable bit sequence).

The transmitter can be operated with framed DS1 which is multiplexed to form a DS1C or DS2, or unframed DS1 multiplexed up to DS1C or DS2, or with unframed data produced at any one of three rates.

Error rates for BIT and BPV (Bipolar violations) are selected between 9 x 10^{-3} and 1 x 10^{-9} using the thumbwheel switches. Front panel switches are also provided to insert individual bit or BPV errors into the transmitted data. An input for an external clock is available on the front panel which can be used for jitter testing when desired. BNC-type connectors for PRBS, ERROR and M-FRAME SYNC pulses are also provided on the front panel.

1.4 TECHNICAL CHARACTERISTICS

A summary of technical characteristics for the Model 4653A Transmitter is provided in the following specifications.

INTERNAL CLOCK Frequency	1.544 Mbps, 3.152 Mbps, 6.312 Mbps (DS1/1C/2) crystal sources
Stability	±15 ppm, 0° to 50°C

EXTERNAL CLOCK INPUT	
Connector	BNC
Frequency	1 MHz to 10 MHz
Impedance	75Ω, ac coupled
Amplitude	1-5V peak-to-peak
CLOCK OUTPUT	
Connector	BNC
Impedance	75Ω
Amplitude	TTL, 0-3V
DATA FORMATS (See Note page 1-5)[1]	
Pseudo Random Bit Sequence (PRBS)	1,048,575 bit sequence, 15 or 14 zero suppression (see Section 3.4-B), with all control bits. DS2 output uses B6ZS coding for framed or unframed, DS1C uses modulo-2 scrambling for framed only.
Minimum Density	If the DS1 signal is framed, MIN DENSITY is 2 ones and 14 zeros, and if unframed, it is a single one and 15 zeros.
All Ones Data	Continuous data sequence of ...111... with control bits
One-Zero Alternate	Alternating sequence of 1010 with control bits
External Data	TTL level input from analyzer using external clock
Programmed	8-bit pattern, user selected by internal DIP switch
ERROR INSERT	Single bit or bipolar violation insert. Bit or bipolar violations from 9×10^{-3} to 1×10^{-9}. Mantissa and exponent adjustable in single steps by thumbwheel switch.
X-BIT	Forces X-bits from 1 to 0
BIPOLAR DATA OUTPUTS	
DS1	
Impedance	Balanced, 110Ω
Level	3V ± 0.3V peak with 0.15V peak imbalance maximum
Width	324 ± 30 ns half amplitude with 15 ns imbalance maximum

Rise/Fall Times	50 ns ± 25 ns, 10% to 90%
Over/Under Shoot	Less than 10%
Balance	Positive pulse/negative pulse power ratio ±0.5 dB
Connector	Accepts WE 310 plug
DS1C	
Level	3V ±0.3V peak
Width	159 ±20 ns at half amplitude
Rise/Fall Times	25-50 ns, 20% to 80%
Over/Under Shoot	Less than 10%
Baseline Noise During a Zero	Peak-to-peak noise less than 10% of peak signal
Balance	Positive pulse/negative pulse power ratio <±0.5 dB
Connector	Accepts WE 310 plug
DS2	
Level	HI: 2.1V peak ± 1dB DSX: Simulates HI pulse passed through 1000 ± 100 feet of 22 gauge ABAM cable LOW: Simulates DSX pulse passed through additional 1000 ± 100 feet of 22 gauge ABAM cable and attenuated by additional 6 dB
Connector	Accepts WE 310 plug
SYNC OUTPUTS	PRBS, ERROR, FRAME. 50Ω, TTL. See Table 3-1.
REDUCE LEVEL	DS1: -24 dB DS1C: -24 dB DS2: -40 dB
GENERAL	
Power Supply	115/220V ac ± 10%, 50-60 Hz linear supply, or optional 115/220V ac -22 to -60V dc, positive ground (station battery) switching supply. 50 watts
Weight	20 lbs.

Dimensions	13"W x 15"D x 5.25"H
Temperature	Operating: 0° to 50°C Storage: -20° to 50°C

NOTE: [1] Formats refer to the DS1 Signal or to Unframed DS1C/DS2. For framed DS1C/DS2, 2 or 4 DS1 channels are multiplexed with all overhead bits including stuffing. Channel 1 is inverted and delayed one bit successively to form other channels.

CHAPTER 2
INSTALLATION

2.1 GENERAL

Initial preparation of the transmitter for operation along with various set-up configurations are described below. Operating instructions are provided in Chapter 3 - OPERATION.

2.2 UNPACKING AND INSPECTION

Carefully unpack the shipping cartons observing all printed instructions. Separate the packing material from the main unit and any packages of loose items (hardware, cables, connectors, etc.). Temporarily set the shipping cartons and packing material aside in a safe place and inspect the unit and associated items (if any) for shipping damage. If damage is evident, contact both the carrier and the nearest Scientific-Atlanta sales representative immediately. Save the packing materials and shipping papers for inspection by the carrier's representative. Do not return a unit to Scientific-Atlanta without receiving specific return shipment instructions.

Save the shipping cartons and packing material even after satisfactory operation of the Model 4653A Transmitter is determined. They may be useful for storage, or for protection during future transport of the equipment.

An inventory checklist is provided in Section 2.3 for accessories supplied with your unit. Should an item be missing or damaged from the accessory kit, contact your nearest Scientific-Atlanta representative for assistance.

2.3 ACCESSORIES SUPPLIED

The Model 4653A Transmitter comes complete with the following Accessory Kit (Part No. 304138).

___ Operator's Manual (Part No. 256025)
___ Power Cord (Part No. 89672)
___ Fuses:
    ___ .5 Amp Slo Blo (Part No. 71217)
    ___ 1.5 Amp Slo Blo (Part No. 71222)
    ___ 2 Amp Slo Blo (Part No. 71223)
    ___ 4 Amp Slo Blo (Part No. 71229)
    ___ 5 Amp Slo Blo (Part No. 71232)
    ___ 10 Amp Slo Blo (Part No. 71236)
___ Connector, Rect. Plug Housing (Part No. 89689)
___ Connector, Contact Pin (Part No. 87460)

In addition, a Model 4653A Service Accessory Kit (Part No. 304139) is available. The kit contains the following items:

1. Maintenance Manual (Part No. 256026)
2. Printed Circuit Board Extender (Part No. 221035)
3. Card Puller (Part No. 254439)

For further information on obtaining a Service Accessory Kit, contact your local Scientific-Atlanta representative, or write/call: Scientific-Atlanta, Instrumentation Factory Service Department, 4388 Shackleford Road ATL 28-B, Norcross, Georgia 30093, Phone (404) 925-5277.

2.4 INSTALLATION

A. POWER SOURCE

The Model 4653A Transmitter is available with ac only or ac/dc power supplies. The ac only type operates from 115V/220V 50-60 Hz. The ac/dc operates

from 115V/220V 50-60 Hz or from a positive ground battery source providing from -22V to -60V dc.

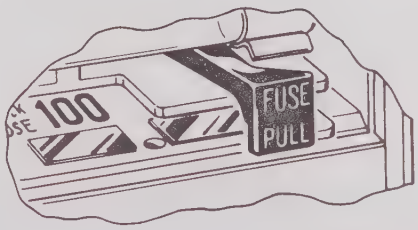
CAUTION

BE SURE THE FRONT PANEL POWER SWITCH IS IN THE OFF (DOWN) POSITION BEFORE CONNECTING BATTERY SOURCE VOLTAGE. ALTHOUGH THE CIRCUITS ARE VOLTAGE PROTECTED, IT IS POSSIBLE TO BLOW A PROTECTING FUSE WHICH IS MOUNTED INTERNALLY AND REQUIRES PARTIAL DISASSEMBLY TO PERMIT REPLACEMENT.

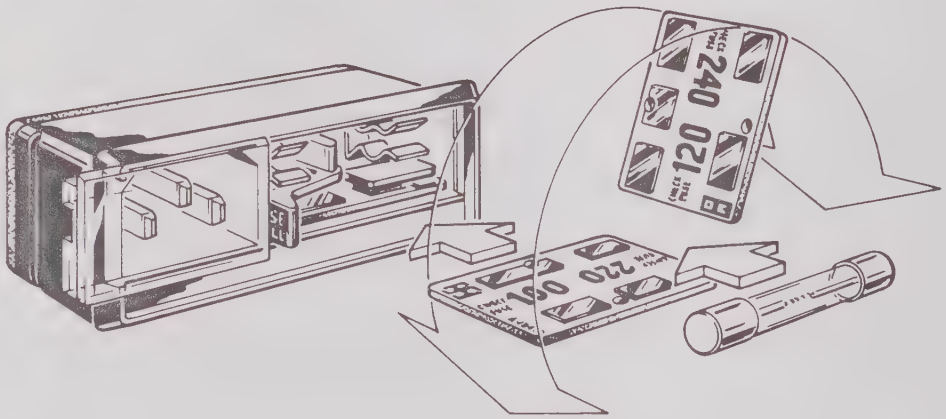
If there is any question, check the source with a meter to verify that the voltage is within operating range required by the equipment. Connecting the equipment to both ac and dc power sources simultaneously is permissible. The power supply circuit rectifies and filters the stepped down ac voltage which is directed through a diode OR circuit with the applied dc source voltage. The greater voltage will act as the power source for the equipment.

The rectified ac source potential is approximately 55V dc. If the dc source potential is less than 55V dc, the ac source will power the equipment. Likewise, if the dc potential is greater than 55V dc, the dc source will power the equipment. This arrangement permits highly reliable uninterrupted service modes. The equipment will operate from the higher source potential only and presents minimum drain on the unused source.

Occasionally, a fuse fails and requires replacement. For ac fuse replacement, refer to Figure 2.1. Use only the proper fuse size and rating labeled on the rear panel. DC voltage input fuses are located on a printed circuit board mounted to the inside of the rear panel. Access to these fuses is possible after removing the equipment's top and bottom covers. On the ac only models, the dc voltage fuses are on the power supply board, which can be accessed by removing the top cover only.



Operating voltage is shown through the sliding plastic window.



HOW TO SELECT OPERATING VOLTAGE

1. Remove the ac power cord connector.
2. Slide the plastic window to the left.
3. Carefully operate FUSE PULL tab to the left.
4. Carefully remove both the fuse and printed circuit board. A small hole is provided to accommodate a wire pull if necessary.
5. Correctly orient the printed circuit board so the desired voltage is located on the top left side.
6. Carefully return the printed circuit board to the original location. Be sure it is securely seated.
7. Return FUSE PULL tab to the normal position.
8. Replace the original fuse with one selected for correct fuse value.

Illustrations courtesy of Corcom Corp., Chicago, Ill.

Figure 2.1. Selecting the Proper Operating Voltage

B. TYPICAL TEST CONFIGURATIONS

The complete Model 4653A/4654A Error Rate Analyzer Set is intended to make digital-to-digital measurements on DS1, DS1C, and DS2 digital transmission equipment. Applications can be extended into the DS3 domain with the addition of the Model 4656 DS3 to DS2 Demultiplexer. In general, perform measurements in either a loop-back or end-to-end configuration. A single set (4653A/4654A) is used for loop-back testing, while two sets are required to perform the end-to-end tests in both directions. Live traffic bipolar violation errors are monitored with a single Model 4654A Analyzer. Bit errors or bipolar violations are inserted into live traffic by feeding the live traffic bipolar signal into a Model 4654A Analyzer. The CLOCK and DATA outputs from the rear panel of the analyzer are connected to the CLOCK and DATA inputs on the front panel of a Model 4653A Transmitter. The transmitter then regenerates a bipolar signal. Errors can be inserted using the AUTO or SINGLE error insert switches.

1. End-to-End Test

Two Model 4653A/4654A Sets are required to perform simultaneous End-to-End Tests in both directions. A typical set-up is illustrated by the block diagram in Figure 2.2. Patching the respective Model 4653A Transmitter and Model 4654A Analyzer into system signal paths, each Model 4654A Analyzer test evaluates the transmission of the opposite end Model 4653A Transmitter. Common tests include bit and bipolar-violation error rates, total errors, error seconds, etc. The results are retained on permanent copy when the Model 4650 Printer Option is used.

2. Loop-Back Test

Both the Transmitter and Analyzer of a Model 4653A/4654A arrangement are required to perform Loop-Back Tests on cable, digital radio, and fiber optics systems, or on digital modems. The "channel-under-test" transmitter output is connected to the system receiver. The output signal from a Model 4653A Transmitter connects to the system transmitter and a Model 4654A Analyzer connects to the system receiver output. This set-up is illustrated in Figure 2.3.

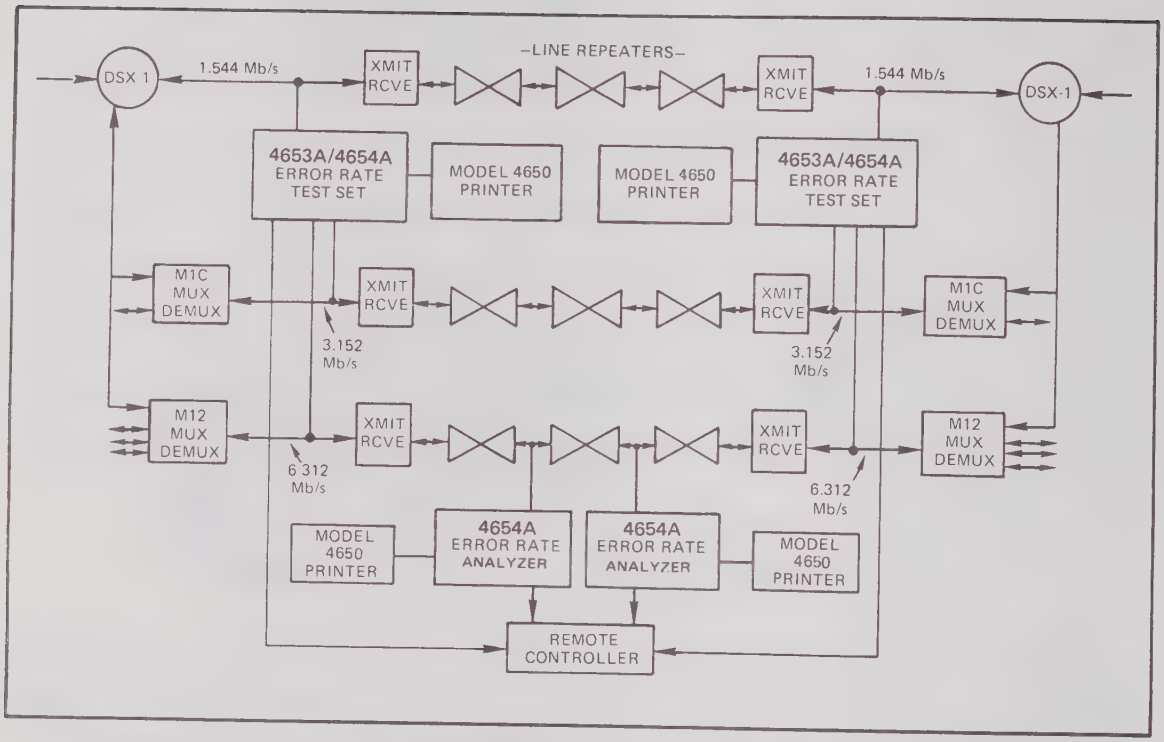


Figure 2.2. Typical Configurations for Testing Digital Networks with the Model 4653A/4654A Error Rate Analyzer Set

3. Digital Modem Testing

The Model 4653A/4654A equipment can be used for either production or field testing on digital subsystems which include the modulator/encoder/scrambler. A typical connection arrangement is shown by the block diagram in Figure 2.4.

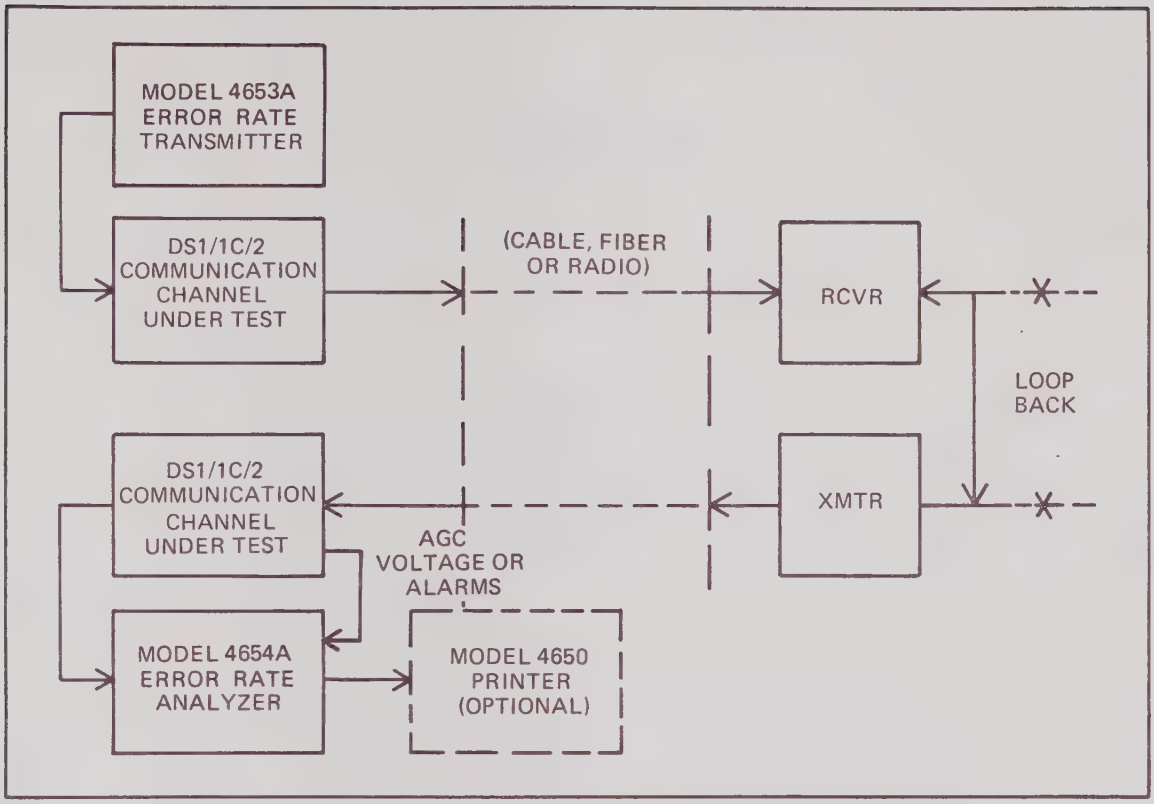


Figure 2.3. System Loop-Back Test Using Model 4653A/4654A Equipment, Block Diagram

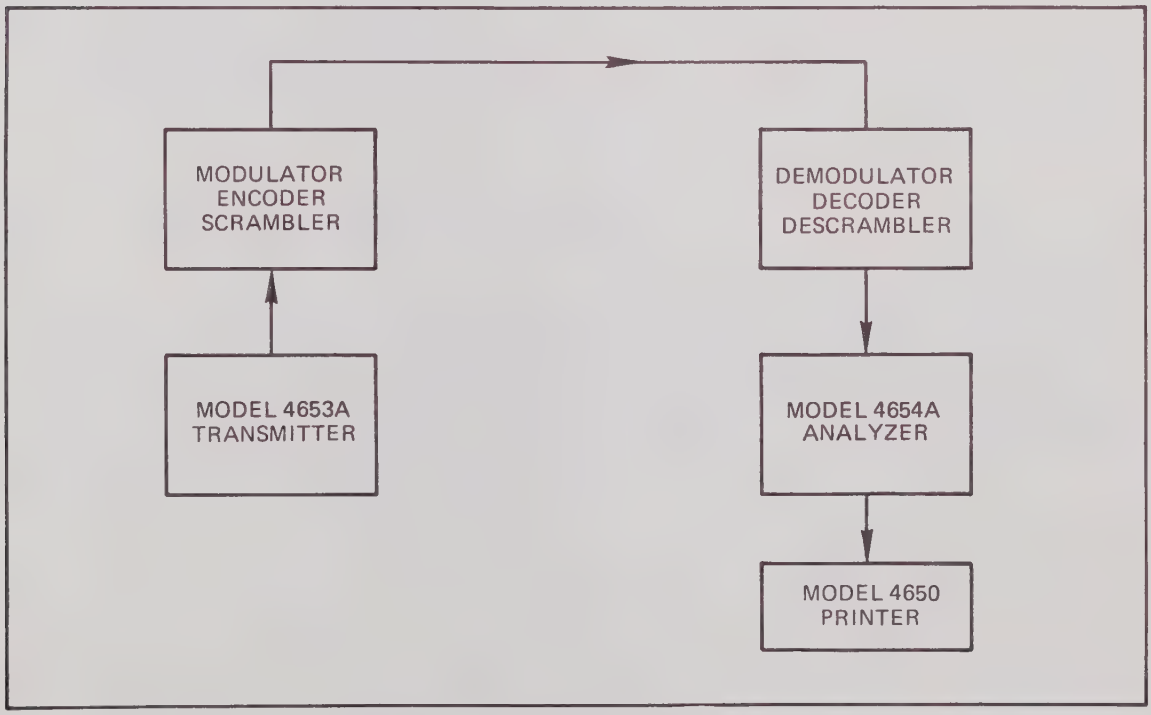


Figure 2.4. Digital Modem Test

CHAPTER 3
OPERATION

3.1 GENERAL

Read this chapter thoroughly before actually using the Model 4653A Transmitter. While the equipment cannot be damaged by front panel control settings, an understanding of the control functions reduces the time required to obtain valid measurements. Instructions for initial start-up and general operation are discussed in detail.

The Model 4653A Transmitter provides the circuitry required to generate a DS1/1C/2 formatted signal or NRZ (Non-Return to Zero) data and clock. Other functions provided to simplify digital data link testing include:

- Selection of output signal levels on DS2
- Selection of data pattern
- Selection of error rates
- Insertion of individual errors
- Selection between the internal clock or an externally supplied clock.

3.2 FRONT PANEL CONTROLS AND INDICATORS

The front panel control switches and indicators of the Model 4653A Transmitter are numerically identified in Figure 3.1. Understanding these control switches and indicators before initiating a test provides test procedure results containing the information desired. Functions of the control switches and indicators are listed in Table 3.1.

Table 3.1
Identification of Controls and Indicators
(Refer to Figure 3.1)

Reference Symbol	Panel Decal	Functional Description
1	(OUTPUT SELECT) DS1	When DS1 is depressed, the transmitter outputs a DS1 signal format from the four output connectors (20).
2	(OUTPUT SELECT) DS1C	When DS1C is depressed, the transmitter outputs a DS1C signal format from the four output connectors (20).
3	(OUTPUT SELECT) DS2-LO	When this switch is depressed, the transmitter outputs a DS2 format signal equal to the DS2-DSX(4) signal modified by passing through a network that simulates 1000 feet of 22-gauge ABAM cable and attenuated by 6 dB. This signal is only available at the single output connector labeled DS1/1C/2 (20).
4	(OUTPUT SELECT) DS2-DSX	When this switch is depressed, the transmitter outputs a DS2 format signal equal to the DS2-HI (5) signal modified by passing through a network that simulates 1000 feet of 22-gauge ABAM cable. This signal is only available at the single output connector labeled DS1/1C/2 (20).
5	(OUTPUT SELECT) DS2-HI	When this switch is depressed, the transmitter outputs a DS2 format signal with an amplitude of ±2.1 volts (±1 dB) from the single output connector labeled DS1/1C/2 (20).
6	DATA - Type Select Switches	These switches select the type of data pattern the transmitter will output. (See Note on page 1-5.) PRBS is a pseudo-random bit sequence 1,048,575 (2^{20}-1) bits long. MIN DENSITY Framed DS1 - 14 zeros followed by two ones; Unframed DS1 - 15 zeros followed by a single one. 1111 is a signal consisting of all ones. 1010 is a signal consisting of alternately ones and zeros.

Table 3.1 - continued

Reference Symbol	Panel Decal	Functional Description
16	SYNC OUTPUT (continued)	PRBS provides a pulse when the pseudo-random bit sequence repeats. (Detected by 1 one and 19 zeros in 20 stage shift register.) ERROR provides a pulse synced to the error insertion locations. FRAME provides access to the Frame sync pulse (one pulse per M-Frame for DS1C/DS2 and for every framing bit for DS1).
17	INPUT Connectors	These BNC-type connectors are used to input the external CLOCK and/or DATA if selected by the switches EXT (6) and EXT CLOCK (10).
18	OUTPUT Connectors	These BNC-type connectors provide access to the transmitter CLOCK and DATA. Both are TTL-level from 50-ohm drivers. CLOCK provides access to the clock as selected by the DS1, DS1C, or DS2 switches (1-5) or the external clock if it has been selected by EXT CLOCK (10). DATA provides access to the output data in NRZ format as selected by the DATA (6) switches.
19	POWER ON Switch and Indicator	A two-position switch for turning on or off power to the transmitter. A green LED above the switch indicates power on when illuminated.
20	OUTPUT Connectors	A group of four signal output connectors that will accept a WE-310 type plug. The two top and lower left connectors can output a DS1 or DS1C signal as selected by the OUTPUT SELECT switches (1,2). The lower right connector can output a DS1, DS1C, or DS2 signal as selected by OUTPUT SELECT (1-5) switches. These outputs are 110-ohm, balanced source impedance.

3.3 REAR PANEL CONNECTORS

Figure 3.2 shows the rear panel of a Model 4653A Transmitter and the location of the ac and dc power source connectors. The dc connector is not on the ac-only option. Access to the ac power source connector fuse is illustrated in Chapter 2 - Installation, Figure 2.1.

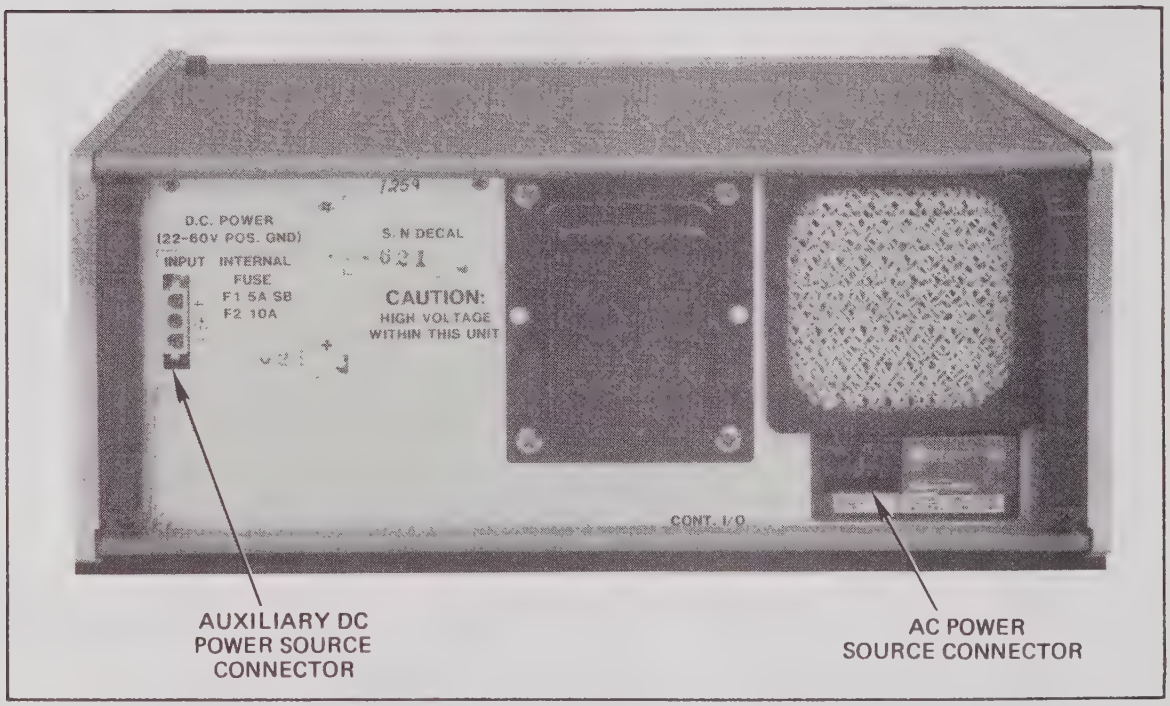


Figure 3.2. Typical Rear Panel Features

Photo #13610

3.4 OPERATION

General. Although the operation of the Model 4653A Transmitter has been described in figures and tables, there are some operational modes of complex nature requiring additional operating instructions. These instructions usually pertain to switches requiring a proper sequence to achieve a desired result or to the interaction of various switch combinations.

Detailed instructions for the following switch and/or connector groups are given in the following paragraphs:

A. OUTPUT SELECT
B. DATA Type Select
C. ERROR INSERT SELECT
D. OUTPUT Connectors
E. INPUT Connectors

A. OUTPUT SELECT

These switches select the type of signal that appears at the WE-310 type connector on the front panel. Pressing DS1 gives a DS1 output signal (1.544 Mbit/s) on all four jacks. Pressing DS1C gives a DS1C output signal (3.152 Mbit/s) on all four jacks. Pressing DS2-HI provides a DS2 (6.312 Mbit/s) output signal level of ±2.1 volts (±1 dB) in amplitude, on the single DS2 connector. Pressing DS2-DSX provides an output from the DS2 connector that is the DS2-HI signal modified by passing through a network that simulates 1000 feet of 22-gauge ABAM cable. Pressing the DS2-LO provides an output from the DS2 connector that is the DS2-DSX signal modified by passing through a network that simulates an additional 1000 feet of 22-gauge ABAM cable plus an attenuation of 6 dB. Each output connector is individually isolated.

B. DATA TYPE SELECT

Selection of one of the DATA switches determines the DS1/1C/2 output signal format.

1. Pseudo-Random Bit Sequence Select

If the PRBS switch is pressed and remains in, the data stream is a pseudo-random sequence of 1,048,575 (2^{20}-1) bits generated in a 20-stage shift register, the input of which is the exclusive-ORed combination of the 17th and 20th stage outputs. The PRBS pattern is acted on by a zero suppression circuit to prevent excess zeros for a DS1 signal. The zero suppression follows the form:

1) DS1 unframed - 15 zero
2) DS1 framed - 14 zero
3) DS1C framed (unframed DS1) - 15 zero
4) DS1C framed (framed DS1) - 14 zero
5) DS1C unframed - selectable to 15 or none
6) DS2 framed (unframed DS1) - 15 zero
7) DS2 framed (framed DS1) - 14 zero
8) DS2 unframed - selectable to 15 or none
9) External Clock - selectable 15 or none

NOTE: The 15 or none mode is selectable through an internal jumper. All selectable modes perform to the setting of the single jumper. See Figure 3.3 for the location of the jumper.

2. Minimum Density Select

If the MIN DENSITY switch is pressed and remains in, the pattern is defined as:

DS1 (unframed): 1-one, 15-zeros
DS1 (framed): 2-ones, 14-zeros
DS1C (framed - unframed DS1): 1-one, 15-zeros
DS1C (framed - framed DS1): 2-ones, 14-zeros
DS1C (unframed): 1-one, 15-zeros
DS2 (framed - unframed DS1): 1-one, 15-zeros
DS2 (framed - framed DS1): 2-ones, 14-zeros
DS2 (unframed): 1-one, 15-zeros
Ext Clock: 1-one, 15-zeros

3. All Ones Select

If the 1111 switch is pressed and remains in, the OUTPUT signal consists of only ones in the data bits.

4. Alternate One-Zero Select

If the 1010 switch is pressed and remains in, the OUTPUT signal consists of alternately ones and zeros in the data bits.

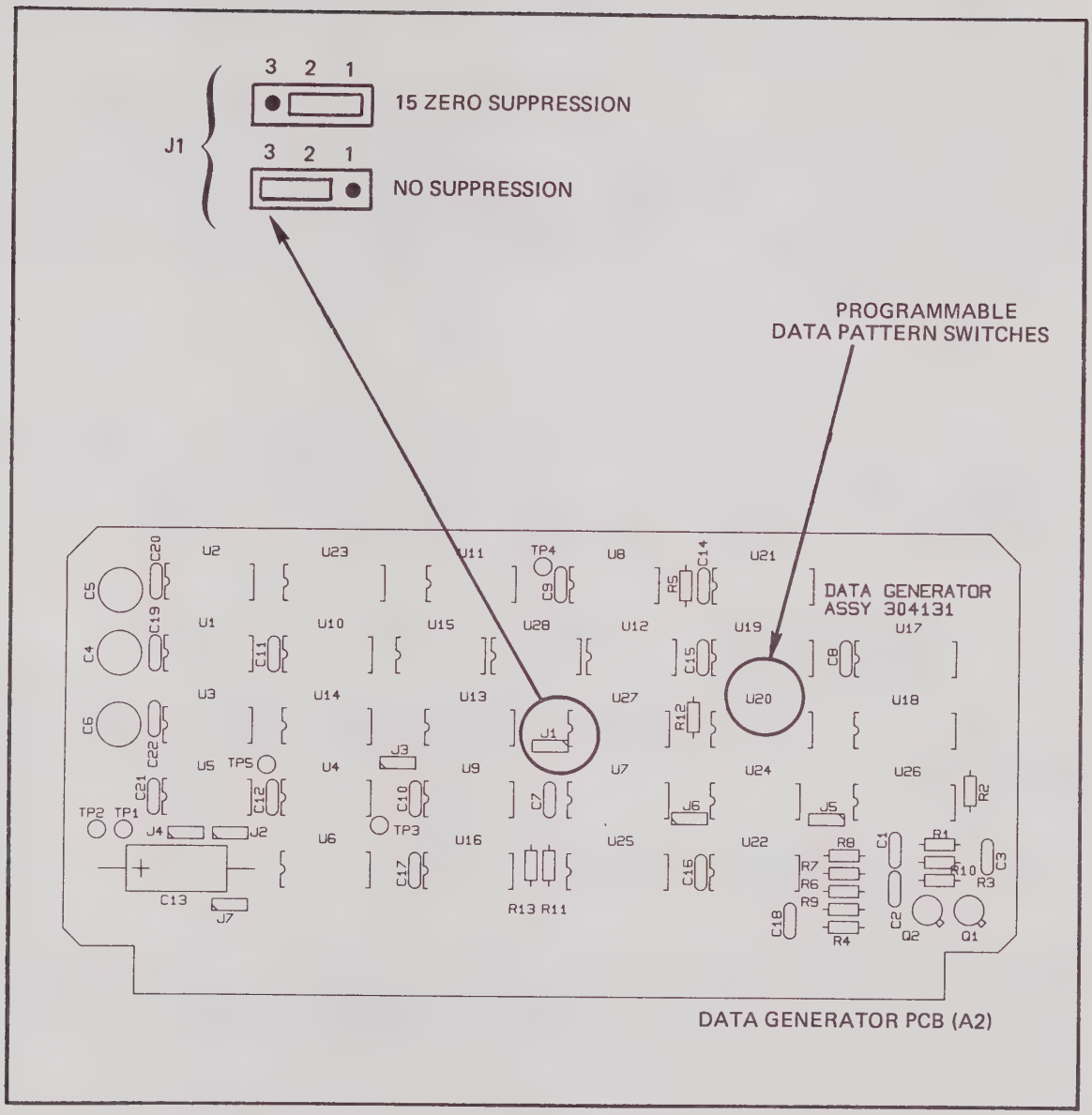


Figure 3.3. Location of Programmable Data Pattern Switches and Zero Suppression Jumper

5. External Data Select

If the EXT switch is pressed and remains in, the OUTPUT signal data bits are whatever data is input to the INPUT-DATA BNC connector.

6. Programmable Data Select

If the PROG switch is pressed and remains in, the OUTPUT signal data bits are whatever 8-bit pattern presently set on the internal DIP-switch. This pattern will repeat over-and-over until manually changed on the DIP-switch. This switch is located on the DATA GENERATOR PCB (A2). See Figure 3.3 for the location of the switches.

7. Reduce Level Select

This is a momentary contact switch which, when depressed, causes the transmitter OUTPUT signal to be reduced on all appropriate output jacks as follows: DS1: -24 dB, DS1C: -24 dB, DS2: -40 dB.

8. X-BIT Select

This is a momentary contact switch which, when depressed, causes the X-bit to be a "0". When the switch is in the released position, the X-bit is always a "1".

9. Framing Disable Select

If the FRAMING switch is pressed to the out position, the framing is disabled and whatever bit pattern is selected, is output at the full rate depending on the selected mode by the OUTPUT SELECT switches. If framing is on, the output is:

DS1 - Pattern selected plus DS1 Framing bits.

DS1C - The pattern is generated at a DS1 rate and two are multiplexed to form the Data. The output signal contains this data plus DS1C framing bits. (NOTE: The DS1 signals can contain DS1 framing bits if the internal jumper is set to DS1 Framing Enable. See Figure 3.4.)

DS2 - The pattern is generated at a DS1 rate and four are multiplexed to form the Data. The output signal contains this data plus DS2 framing bits. (NOTE: The DS1 signals can contain DS1 framing bits if the internal jumper is set to DS1 Framing Enable. See Figure 3.4.)

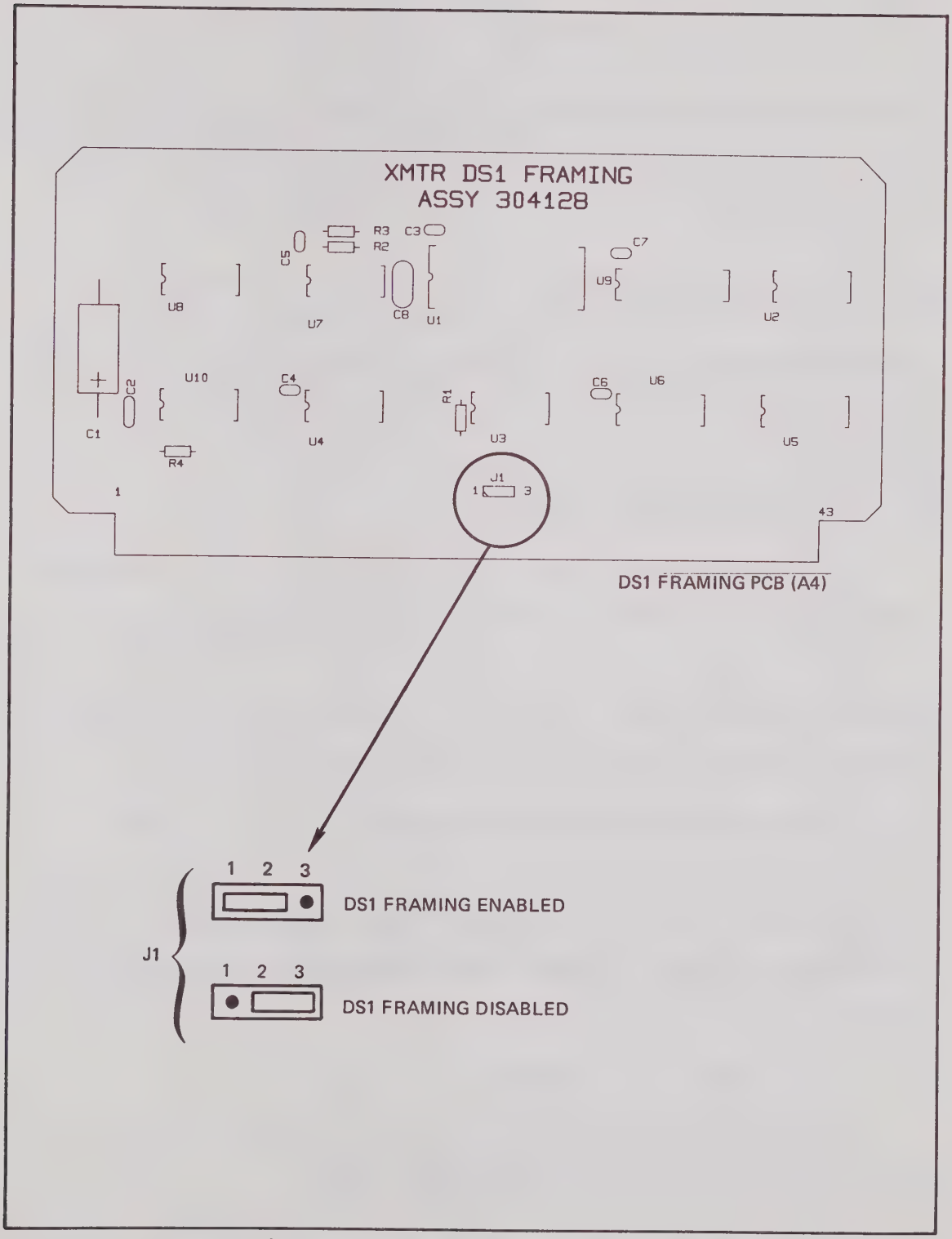


Figure 3.4. Location of DS1 Framing Selection Jumper

10. External Clock Select

If the EXT CLOCK switch is pressed and remains in, it allows an external clock to be input to the transmitter through the INPUT CLOCK BNC connector. The selected pattern is generated at this rate and multiplexing and framing is internally disabled.

C. ERROR INSERT SELECT

These switches, along with the thumbwheel switches below them, are used to select the type of errors, and the rate the errors are inserted into the data stream.

1. Auto Bit Error Select

If the DS1 BIT (AUTO) switch is pressed and remains in, bit errors are inserted into the transmitter OUTPUT at a rate determined by the setting of the AUTO RATE thumbwheel switches. These thumbwheel switches can be set for zero error rate and rates from 1 x 10^{-9} to 9 x 10^{-3}. If DS1 BIT AUTO and BPV AUTO are on simultaneously, the bit error rate will be 2 or 4 times faster than thumbwheel switch setting in DS1C or DS2 framed operation.

2. Auto Bipolar Violation Error Select

If the DS1 BPV (AUTO) switch is pressed and remains in, BPV errors are inserted into the transmitter OUTPUT at a rate determined by the setting of the AUTO RATE thumbwheel switches. The setting range is the same as for bit errors.

3. Single Bit Error Select

DS1 BIT (SINGLE) is a momentary contact switch. When depressed, it inserts a single bit error into the transmitter OUTPUT.

4. Single Bipolar Violation Error Select

BPV (SINGLE) is a momentary contact switch. When pressed, it inserts a single BPV error into the transmitter OUTPUT.

D. OUTPUT CONNECTORS

Five BNC-type connectors, each with 50-ohm drive capability are provided. PRBS-SYNC connector provides one pulse per each 1,048,575-bit sequence. This pulse occurs at the beginning of the PRBS when the 20-stage shift register contains a one and 19 zeros. ERROR connector provides a pulse synced to the error insert locations. FRAME provides one output pulse per M-Frame for DS1C and DS2. However, DS1 outputs one pulse per frame. Both CLOCK and DATA connectors provide NRZ outputs. The NRZ DATA signals contain framing bits and both DATA and CLOCK output signals, and can be directly connected in NRZ applications.

E. INPUT CONNECTORS

These two BNC-type connectors are used to accept an external CLOCK and NRZ data signal. External clock and/or data signals are selected by the EXT CLOCK and DATA-EXT switches located above the INPUT Connectors. External data are any generated NRZ data pattern. External Clock is any frequency in the range of 1 MHz to 10 MHz. However, framing is disabled when EXT CLOCK is selected and the data pattern (internal or external) is output at the clock rate. To regenerate live traffic signals (with or without error-insertion), the Clock and Data output signals from a Model 4654A Analyzer are fed to these two INPUT connectors.

CONVERSION OF VOLTAGE AND POWER RATIOS TO DECIBELS

The basic chart below indicates the number of decibels (dB) corresponding to the listed ratios of voltage or power over the range of −20 to +20 dB. For voltage or power ratios greater than those included in the chart, the ratio can be broken down into a product of two numbers, the value in dB for each found separately, and the two results added. Example: To convert a power ratio of 2,000:1 to dB, express 2,000 as 2×10^3; the number of dB corresponding to a power ratio of 2 is very nearly 3, and the number of dB for a power ratio of 10^3 is 30. Therefore, the power ratio of 2,000:1 is approximately 30 dB + 3 dB = 33 dB. In the lower righthand corner of the chart dB values for voltage and power ratios of integral powers of 10 are given.

Voltage Ratio	Power Ratio	−dB+	Voltage Ratio	Power Ratio	Voltage Ratio	Power Ratio	−dB+	Voltage Ratio	Power Ratio	Voltage Ratio	Power Ratio	−dB+	Voltage Ratio	Power Ratio
1.000	**1.000**	**0**	**1.000**	**1.000**	**.447**	**.200**	**7.0**	**2.239**	**5.012**	**.200**	**.0398**	**14.0**	**5.012**	**25.12**
.989	.977	.1	1.012	1.023	.442	.195	7.1	2.265	5.129	.197	.0389	14.1	5.070	25.70
.977	.955	.2	1.023	1.047	.437	.191	7.2	2.291	5.248	.195	.0380	14.2	5.129	26.30
.966	.933	.3	1.035	1.072	.432	.186	7.3	2.317	5.370	.193	.0372	14.3	5.188	26.92
.955	.912	.4	1.047	1.096	.427	.182	7.4	2.344	5.495	.191	.0363	14.4	5.248	27.54
.944	.891	.5	1.059	1.122	.422	.178	7.5	2.371	5.623	.188	.0355	14.5	5.309	28.18
.933	.871	.6	1.072	1.148	.417	.174	7.6	2.399	5.754	.186	.0347	14.6	5.370	28.84
.923	.851	.7	1.084	1.175	.412	.170	7.7	2.427	5.888	.184	.0339	14.7	5.433	29.51
.912	.832	.8	1.096	1.202	.407	.166	7.8	2.455	6.026	.182	.0331	14.8	5.495	30.20
.902	.813	.9	1.109	1.230	.403	.162	7.9	2.483	6.166	.180	.0324	14.9	5.559	30.90
.891	**.794**	**1.0**	**1.122**	**1.259**	**.398**	**.159**	**8.0**	**2.512**	**6.310**	**.178**	**.0316**	**15.0**	**5.623**	**31.62**
.881	.776	1.1	1.135	1.288	.394	.155	8.1	2.541	6.457	.176	.0309	15.1	5.689	32.36
.871	.759	1.2	1.148	1.318	.389	.151	8.2	2.570	6.607	.174	.0302	15.2	5.754	33.11
.861	.741	1.3	1.161	1.349	.385	.148	8.3	2.600	6.761	.172	.0295	15.3	5.821	33.88
.851	.724	1.4	1.175	1.380	.380	.145	8.4	2.630	6.918	.170	.0288	15.4	5.888	34.67
.841	.708	1.5	1.189	1.413	.376	.141	8.5	2.661	7.079	.168	.0282	15.5	5.957	35.48
.832	.692	1.6	1.202	1.445	.372	.138	8.6	2.692	7.244	.166	.0275	15.6	6.026	36.31
.822	.676	1.7	1.216	1.479	.367	.135	8.7	2.723	7.413	.164	.0269	15.7	6.095	37.15
.813	.661	1.8	1.230	1.514	.363	.132	8.8	2.754	7.586	.162	.0263	15.8	6.166	38.02
.804	.646	1.9	1.245	1.549	.359	.129	8.9	2.786	7.762	.160	.0257	15.9	6.237	38.90
.794	**.631**	**2.0**	**1.259**	**1.585**	**.355**	**.126**	**9.0**	**2.818**	**7.943**	**.159**	**.0251**	**16.0**	**6.310**	**39.81**
.785	.617	2.1	1.274	1.622	.351	.123	9.1	2.851	8.128	.157	.0246	16.1	6.383	40.74
.776	.603	2.2	1.288	1.660	.347	.120	9.2	2.884	8.318	.155	.0240	16.2	6.457	41.69
.767	.589	2.3	1.303	1.698	.343	.118	9.3	2.917	8.511	.153	.0234	16.3	6.531	42.66
.759	.575	2.4	1.318	1.738	.339	.115	9.4	2.951	8.710	.151	.0229	16.4	6.607	43.65
.750	.562	2.5	1.334	1.778	.335	.112	9.5	2.985	8.913	.150	.0224	16.5	6.683	44.67
.741	.550	2.6	1.349	1.820	.331	.110	9.6	3.020	9.120	.148	.0219	16.6	6.761	45.71
.733	.537	2.7	1.365	1.862	.327	.107	9.7	3.055	9.333	.146	.0214	16.7	6.839	46.77
.724	.525	2.8	1.380	1.905	.324	.105	9.8	3.090	9.550	.145	.0209	16.8	6.918	47.86
.716	.513	2.9	1.396	1.950	.320	.102	9.9	3.126	9.772	.143	.0204	16.9	6.998	48.98
.708	**.501**	**3.0**	**1.413**	**1.995**	**.316**	**.100**	**10.0**	**3.162**	**10.000**	**.141**	**.0200**	**17.0**	**7.079**	**50.12**
.700	.490	3.1	1.429	2.042	.313	.0977	10.1	3.199	10.23	.140	.0195	17.1	7.161	51.29
.692	.479	3.2	1.445	2.089	.309	.0955	10.2	3.236	10.47	.138	.0191	17.2	7.244	52.48
.684	.468	3.3	1.462	2.138	.306	.0933	10.3	3.273	10.72	.137	.0186	17.3	7.328	53.70
.676	.457	3.4	1.479	2.188	.302	.0912	10.4	3.311	10.96	.135	.0182	17.4	7.413	54.95
.668	.447	3.5	1.496	2.239	.299	.0891	10.5	3.350	11.22	.133	.0178	17.5	7.499	56.23
.661	.437	3.6	1.514	2.291	.295	.0871	10.6	3.388	11.48	.132	.0174	17.6	7.586	57.54
.653	.427	3.7	1.531	2.344	.292	.0851	10.7	3.428	11.75	.130	.0170	17.7	7.674	58.88
.646	.417	3.8	1.549	2.399	.288	.0832	10.8	3.467	12.02	.129	.0166	17.8	7.762	60.26
.638	.407	3.9	1.567	2.455	.285	.0813	10.9	3.508	12.30	.127	.0162	17.9	7.852	61.66
.631	**.398**	**4.0**	**1.585**	**2.512**	**.282**	**.0794**	**11.0**	**3.548**	**12.59**	**.126**	**.0159**	**18.0**	**7.943**	**63.10**
.624	.389	4.1	1.603	2.570	.279	.0776	11.1	3.589	12.88	.125	.0155	18.1	8.035	64.57
.617	.380	4.2	1.622	2.630	.275	.0759	11.2	3.631	13.18	.123	.0151	18.2	8.128	66.07
.610	.372	4.3	1.641	2.692	.272	.0741	11.3	3.673	13.49	.122	.0148	18.3	8.222	67.61
.603	.363	4.4	1.660	2.754	.269	.0724	11.4	3.715	13.80	.120	.0145	18.4	8.318	69.18
.596	.355	4.5	1.679	2.818	.266	.0708	11.5	3.758	14.13	.119	.0141	18.5	8.414	70.79
.589	.347	4.6	1.698	2.884	.263	.0692	11.6	3.802	14.45	.118	.0138	18.6	8.511	72.44
.582	.339	4.7	1.718	2.951	.260	.0676	11.7	3.846	14.79	.116	.0135	18.7	8.610	74.13
.575	.331	4.8	1.738	3.020	.257	.0661	11.8	3.890	15.14	.115	.0132	18.8	8.710	75.86
.569	.324	4.9	1.758	3.090	.254	.0646	11.9	3.936	15.49	.114	.0129	18.9	8.811	77.62
.562	**.316**	**5.0**	**1.778**	**3.162**	**.251**	**.0631**	**12.0**	**3.981**	**15.85**	**.112**	**.0126**	**19.0**	**8.913**	**79.43**
.556	.309	5.1	1.799	3.236	.248	.0617	12.1	4.027	16.22	.111	.0123	19.1	9.016	81.28
.550	.302	5.2	1.820	3.311	.246	.0603	12.2	4.074	16.60	.110	.0120	19.2	9.120	83.18
.543	.295	5.3	1.841	3.388	.243	.0589	12.3	4.121	16.98	.108	.0118	19.3	9.226	85.11
.537	.288	5.4	1.862	3.467	.240	.0575	12.4	4.169	17.38	.107	.0115	19.4	9.333	87.10
.531	.282	5.5	1.884	3.548	.237	.0562	12.5	4.217	17.78	.106	.0112	19.5	9.441	89.13
.525	.275	5.6	1.905	3.631	.234	.0550	12.6	4.266	18.20	.105	.0110	19.6	9.550	91.20
.519	.269	5.7	1.928	3.715	.232	.0537	12.7	4.315	18.62	.104	.0107	19.7	9.661	93.33
.513	.263	5.8	1.950	3.802	.229	.0525	12.8	4.365	19.05	.102	.0105	19.8	9.772	95.50
.507	.257	5.9	1.972	3.890	.227	.0513	12.9	4.416	19.50	.101	.0102	19.9	9.886	97.72
.501	**.251**	**6.0**	**1.995**	**3.981**	**.224**	**.0501**	**13.0**	**4.467**	**19.95**	**.100**	**.0100**	**20.0**	**10.000**	**100.00**
.496	.246	6.1	2.018	4.074	.221	.0490	13.1	4.519	20.42					
.490	.240	6.2	2.042	4.169	.219	.0479	13.2	4.571	20.89		10^{-3}	30		10^3
.484	.234	6.3	2.065	4.266	.216	.0468	13.3	4.624	21.38	10^{-2}	10^{-4}	40	10^2	10^4
.479	.229	6.4	2.089	4.365	.214	.0457	13.4	4.677	21.88					
											10^{-5}	50		10^5
.473	.224	6.5	2.113	4.467	.211	.0447	13.5	4.732	22.39	10^{-3}	10^{-6}	60	10^3	10^6
.468	.219	6.6	2.138	4.571	.209	.0437	13.6	4.786	22.91		10^{-7}	70		10^7
.462	.214	6.7	2.163	4.677	.207	.0427	13.7	4.842	23.44	10^{-4}	10^{-8}	80	10^4	10^8
.457	.209	6.8	2.188	4.786	.204	.0417	13.8	4.898	23.99		10^{-9}	90		10^9
.452	.204	6.9	2.213	4.898	.202	.0407	13.9	4.955	24.55					
										10^{-5}	10^{-10}	100	10^5	10^{10}
											10^{-11}	110		10^{11}
										10^{-6}	10^{-12}	120	10^6	10^{12}

Scientific-Atlanta, Inc. 3845 Pleasantdale Rd., Atlanta, Ga. 30340, Tel. 404-449-2000, TWX 810-766-4912, Telex 054-2898, Cable SCIATLADORA

Manual Update Information

This envelope is provided for filing manual update information such as corrections to text, tables, procedures, new or revised drawings, or special application notes. Please use your own filing method to list the update entries in the blank space below.

This is an interim step to provide our customers with both errata and new information for this equipment while the manual is being corrected. If you desire a corrected and revised manual when it becomes available, please write to:

Scientific-Atlanta, Inc.
Instrumentation Publications
3845 Pleasantdale Road
Atlanta, GA 30340

Specify the Manual Title, Publication No., and Printing Date as listed on the title page. Include the Equipment Model No. and Serial No. if available.

www.manualsplus.com